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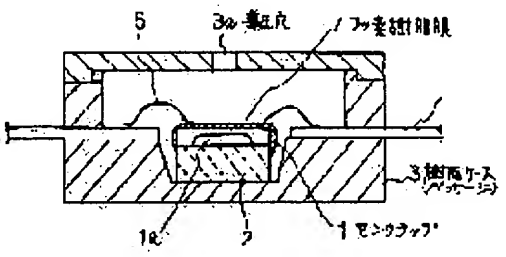
(54) SURFACE PRESSURIZATION TYPE SEMICONDUCTOR PRESSURE SENSOR

(57)Abstract:

PURPOSE: To provide a surface pressurization semiconductor pressure sensor which exhibits excellent environment resistance including moisture resistance while ensuring high measuring sensitivity.

CONSTITUTION: In a surface pressurization type semiconductor pressure sensor wherein a sensor chip 1 having a strain gauge formed on the surface of a silicon diaphragm is mounted on a glass base 2 and assembled into a package 3 and the pressure is measured by introducing pressure to be measured into the package through a pressure introduction hole 3a, the surface of the sensor chip 1 is coated with an environment protective film, i.e., a liquid fluoresin film, which is then thermally cured to form a fluororesin film 7 of 2μm thick or less thus protecting the sensor chip against moisture or outer air contamination.



LEGAL STATUS

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the surface application-of-pressure form semi-conductor pressure sensor applied to the sensor for atmospheric pressure etc.
[0002]
[Description of the Prior Art] Recent years come and the small and lightweight semi-conductor pressure sensor which applied and manufactured the semi-conductor manufacturing technology is used in various fields, such as public welfare and medical application, focusing on the object for automobile engine control. Drawing 5 shows the conventional structure of the surface application-of-pressure form semi-conductor pressure sensor (resin package type) constituted as a sensor for atmospheric pressures, and sets it to drawing. The sensor chip which 1 has arranged diffusion mold strain gage resistance on the front face of a silicon diaphragm, made arrange an integrated circuit, the resistance for temperature characteristic adjustment, etc. around it, and was constituted, A resin case and 4 the glass plinth in which 2 carried the sensor chip 1, and 3 An external derivation terminal, 5 is the aluminum wire which connected between the terminal of the sensor chip 1, and the external derivation terminals 4, and connecting hole 3a opened to the atmospheric-air side is carrying out opening to the covering device of the resin case 3 by making diaphragm space 1a by the side of the rear face of the sensor chip 1 into a vacuum.
[0003] The principle of operation of this semiconductor pressure sensor is common knowledge, changes into an electrical signal change of the measuring pressure-ed force led to the front face of the sensor chip 1 through connecting hole 3a of a case 3 as change of the piezoresistance on a diaphragm, and detects atmospheric pressure as absolute pressure. On the other hand, this surface application-of-pressure form semi-conductor pressure sensor has a possibility that the resistance of a strain gage may change and the output characteristics of a pressure sensor may receive an adverse effect, when the front face of the sensor chip 1 is directly exposed to the open air and dirt is received during a real activity. For this reason, the front face of the sensor chip 1 and the aluminum wire 5 is closed by the protective layers 6, such as silicone oil or silicone gel, and he protects from open air contamination and corrosion, and is trying to raise the resistance to environment of a pressure sensor in the former.
[0004]
[Problem(s) to be Solved by the Invention] By the way, with a configuration, there is a trouble like degree account from which the front face of a sensor chip was protected from open air contamination using silicone oil, silicone gel, etc. as mentioned above conventionally.
(1) In the thing using a liquid like silicone oil as a protective material, before the measuring pressure-ed drawn in the case spreads for a sensor chip, decrease greatly and sensitometry falls. Moreover, it causes a cost rise that there is a possibility that a liquid may flow out of a case through a connecting hole depending on the anchoring position of the pressure sensor at the time of a real activity, therefore special seal structure is needed etc.
[0005] (2) Since silicone gel has large viscosity, it is difficult for the front face of a sensor chip to coat

thinly, and the attenuation rate of the measuring pressure-ed spread for a sensor chip becomes large, and sensitometry falls, so that the thickness of coating becomes thick. Moreover, since a gel protective material is hygroscopic, protective effect sufficient in a damp-proof field is not acquired, and also the dependability in an environmental condition with much dust falls to a front face that dust tends to adhere.

[0006] It is in offering the surface application-of-pressure form semi-conductor pressure sensor excellent in the resistance to environment including moisture resistance, this invention being made in view of the above-mentioned point, and the object solving said technical problem, and securing high sensitometry.

[0007]

[Means for Solving the Problem] In order to attain the above-mentioned object, a fluororesin is made to put on the front face of a sensor chip as environmental protection-proof film in the pressure sensor of this invention. Here, in order to secure the high sensitometry as a pressure sensor, the thickness of said fluororesin is good to adjust to 2 micrometers or less.

[0008] Moreover, after coating the front face of a sensor chip with a liquefied fluororesin by dip coating, the heating cure of the fluororesin film in said configuration can be carried out, and it can carry out hardening formation.

[0009]

[Function] In the above-mentioned configuration, the fluororesin used as a protective coat is a viscous very low liquid in a coating phase, and is thin on the front face of a sensor chip, it is possible to coat homogeneity, attenuation of a propagation pressure is slightly suppressed by adjusting especially thickness to 2 micrometers or less, and the lowering rate of the sensitometry as a pressure sensor can be stored to 10% or less which is convenient in respect of practical use compared with the condition of a bare chip without a protective coat. Moreover, the membraneous quality of the fluororesin in the condition of having carried out the heating cure and having made it hardening is precise, there is no hygroscopicity, and even if it compares with a gel protective coat, it has the property in which dust cannot adhere easily, and thereby, the resistance to environment of sufficient sensor chip is secured.

[0010]

[Example] Hereafter, the example of this invention is explained based on a drawing. In addition, the same sign is given to the same member corresponding to drawing 5 all over drawing of an example.

Example 1: Drawing 1 shows the example of this invention applied to the sensor for absolute-pressure measurement of the same basic configuration as drawing 5 , and the fluororesin film 7 is put on the front face of the sensor chip 1 as environmental protection-proof film.

[0011] This fluororesin film 7 adjusts thickness to 2 micrometers or less, and covering formation is carried out and it explains that formation process to homogeneity by drawing 4 below. That is, in the state of the assembly which built the sensor chip 1 into the resin case 3 (phase before putting a case lid), in a case, the undiluted solution of a liquefied fluororesin or the diluent which carried out concentration adjustment with the solvent is poured in, and the chip sensor 1 is immersed into liquid. Then, after sucking up an excessive fluororesin using an attraction nozzle etc., the fluororesin which adhered so that the front face of the sensor chip 1 might be covered is made to give and harden a heating cure (temperature of 80-180 degrees C), and the fluororesin film 7 is formed. In addition, thickness is changeable in about 0.1-several micrometers by adjusting the concentration of a fluororesin beforehand in the case of the aforementioned immersion process. Moreover, coating of the protective coat is carried out also to a wire by being immersed into the liquid of a fluororesin also including the aluminum wire 5 at a before process.

[0012] By the way, if the fluororesin film 7 is covered on the front face of the sensor chip 1, the measuring pressure-ed force spread for the sensor chip 1 will decline, and the sensitometry of a pressure sensor will fall somewhat. drawing 3 -- measuring pressure-ed force: -- the relation between the thickness of the fluororesin film for which it asked from the location survey result by using 760mmHg as a full scale, and the sensitometry (sensitometry of a bare chip is set to 1) of a pressure sensor -- a table -- it is a thing the bottom and the lowering rate of sensitometry can be stopped to 10% or less which is convenient in respect of practical use by adjusting the thickness of the resin film to 2 micrometers or

less, as shown in drawing.

[0013] Example 2: Drawing 2 shows the example of this invention applied to the sensor for differential pressure detection. In this example, the **** ports 10 and 11 which a package consists of a ceramic substrate 8 and the metal cap 9, and lead the measuring pressure A and B-ed to a substrate 8 and the metal cap 9, respectively are formed, and ****** 2a is punched at the glass plinth 2 so that between the **** port 10 and diaphragm space 1a by the side of the rear face of the sensor chip 1 may be opened further for free passage. With this configuration, measuring pressure B is led to the front-face side of a diaphragm through the **** port 11, and it is added to the sensor chip 1 at the rear-face side of a diaphragm [in / through the **** port 10 / in one measuring pressure A / the sensor chip 1]. Thereby, from the sensor chip 1, the differential pressure of measuring pressure A and B changes into an electrical signal, and is detected.

[0014] And the fluororesin film 7 is put so that a chip front face may be protected to the sensor chip 1 incorporated in the package like the example 1.

[0015]

[Effect of the Invention] As stated above, according to the configuration of this invention, the effectiveness of degree account is done so.

(1) the fluororesin film which coated the front face of a sensor chip with and which it was made to carry out a cure -- a solid-state -- it is -- silicone oil etc. -- like -- the anchoring position of a pressure sensor -- there is no possibility of flowing out of a case by how.

[0016] (2) the membraneous quality of the fluororesin which carried out the cure is precise, and does not have hygroscopicity, and the moisture resistance of a sensor chip improves substantially by this, and also it is securable for the high range which comes out of the sensitometry as a pressure sensor practically by adjusting the thickness to 2 micrometers or less, and is convenient.

(3) Compared with the conventional silicone gel protective coat, dust cannot adhere easily, and the resistance to environment of fluororesin film of a pressure sensor -- it can be used also under an environment with much dust -- improves substantially.

[Translation done.]

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CLAIMS

[Claim(s)]
[Claim 1] The surface application-of-pressure form semi-conductor pressure sensor characterized by making a fluororesin put on the front face of a sensor chip as environmental protection-proof film in the surface application-of-pressure form semi-conductor pressure sensor which carries on a plinth the sensor chip in which the strain gage was formed on the front face of a silicon diaphragm, includes in a package, draws the measuring pressure-ed force in a package, and performs a pressure survey.
[Claim 2] The surface application-of-pressure form semi-conductor pressure sensor characterized by setting thickness of a fluororesin to 2 micrometers or less in a semiconductor pressure sensor according to claim 1.
[Claim 3] The surface application-of-pressure form semi-conductor pressure sensor characterized by having coated the front face of a sensor chip with the liquefied fluororesin by dip coating, having made it harden by the heating cure further in a semiconductor pressure sensor according to claim 1 or 2, and forming the fluororesin film.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The assembly block diagram of the semi-conductor pressure sensor for atmospheric pressure measurement corresponding to the example 1 of this invention
[Drawing 2] The assembly block diagram of the semi-conductor pressure sensor for differential pressure detection corresponding to the example 2 of this invention
[Drawing 3] Drawing showing the relation between the thickness of the fluororesin film, and pressure-sensor sensitometry
[Drawing 4] Drawing showing the formation process of the fluororesin film
[Drawing 5] The assembly block diagram of the semi-conductor pressure sensor for atmospheric pressure measurement in the former
[Description of Notations]
1 Sensor Chip
2 Glass Plinth
3 Resin Case
3a Connecting hole
7 Fluororesin Film (Environmental Protection-proof Film)

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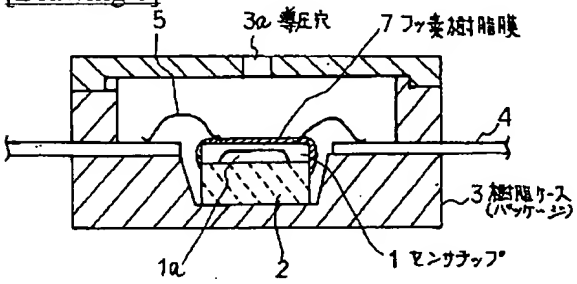
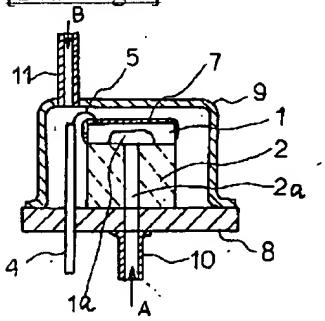
DRAWINGS

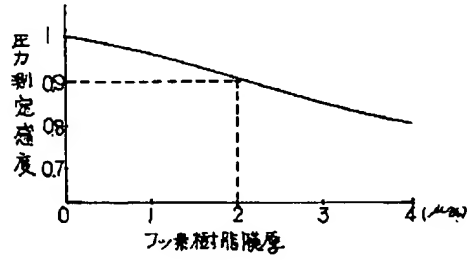
[Drawing 1]



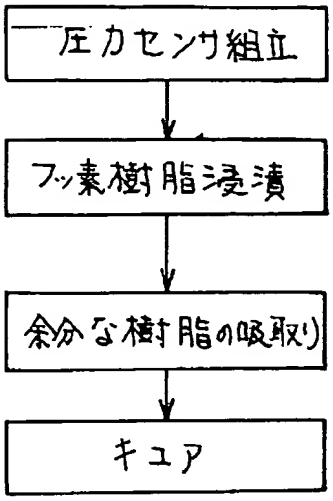
[Drawing 2]



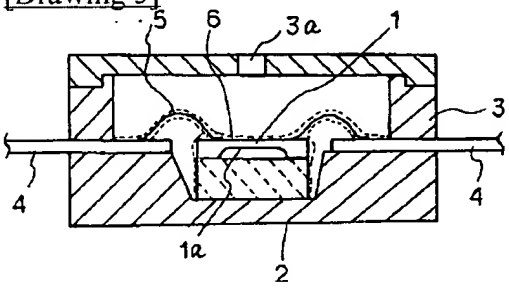
[Drawing 3]



[Drawing 4]



[Drawing 5]



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